THE HENDRY PARTITIONING APPROACH*

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Abstract

This paper provides a brief description of the Hendry partitioning approach. The mechanics of the procedure are explained through an illustration. A brief explanatory note on the nested and mixed-mode partitioning structures is also included.

THE KEY RELATIONSHIP

The Hendry partitioning approach provides an understanding of direct versus indirect competition a product faces. In the Hendry model, two alternatives are assumed to be in direct competition if the switching to (and between) them from any other alternative is in direct proportion to their shares. Let X and Y be dry bleach brands, with brand X having twice the share of brand Y. Furthermore, suppose that switchers from brand Z, whether liquid or dry bleach purchasers, are twice as likely to choose X as to choose Y. Then, brands X and Y are said to be in direct competition. If, on the other hand, X is a dry bleach and Y is a liquid bleach and they are not in direct competition, the switchers are no longer apt to switch to them in proportion to their shares. Paraphrasing Butler (1975):

> Product alternatives are in direct competition if the switching to (and between) them is in proportion to their shares.

Kalwani and Morrison (1977) show that with two assumptions -(1) zero order choice process and (2) switching is proportional to share - the switching between alternative brands i and j in direct competition on two consecutive purchase occasions is given by

$$P_{(i,j)} = K_w S_i S_j, \qquad (1)$$

where K_w is the switching constant for the set of alternatives in direct competition and S_i and S_j are the shares of brands i and j.

The switching constant, K_w, can be shown to be a ratio of the actual switching to the switching under homogeneity in consumer purchase probabilities, when each buyer has probability S_i of purchasing brand i ($i = 1, 2 \ldots, g$). It takes the value zero when the buyers

are completely loyal and always buy their favorite brand. It is equal to one, when the consumers are homogeneous and each buys brand i with probability S_i (i = 1, 2, ..., g). Thus, K_w is a measure of the degree to which consumers are not precommitted to one brand or another and is a property of the choice category as a whole. It should be noted that if the probability density function of consumers in a choice category with g alternatives is given by the Dirichlet distribution, then the interswitching between items i and j is given by equation (1) (Kalwani 1979).

PROCEDURE

The Hendry partitioning method is an iterative trial-and-error procedure. A hypothetical market structure based on "expert judgment" is set up and theoretical switching levels within and between product categories are computed. Empirical switching levels are then compared with the theoretical ones to determine the goodness of fit. Revisions in the hypothetical structure are surmised by noting where the theoretical switching levels exceed the empirical levels and vice-versa. After one or more iterative attempts, a partitioning structure is identified which provides a reasonably good fit to the empirical data.

The empirical switching levels are obtained either from panel (or survey) data by comparing purchases on the previous choice occasion with those on the occasion prior to that. The theoretical switching levels require knowledge of the theoretical switching constant and market shares. In the Hendry model the entropy concept is used to derive an expression for the theoretical switching constant. Its value is a function of only the brand shares within a product category

$$K_W = \frac{\sum_{i=1}^{g} \frac{S_i^2 \ln(1/S_i)}{1 + S_i \ln(1/S_i)}}{\sum_{i=1}^{g} S_i(1 - S_i)} \qquad (2)$$

where S_i is the share of brand i.

For illustration, suppose that in the bleach market the set of dry bleach brands compete directly with one another and thus form a product category. Furthermore, assume that there are only three dry bleach brands, A, B and C, whose shares based on the purchases on the last choice occasion are 0.5, 0.3 and 0.2, respectively. Table 1 displays the computation of the value of the theoretical switching constant. This value of K_W (= 0.4145) is used to obtain the theoretical switching levels using equation (1). The theoretical repeat purchase proportions are easily calculated by subtracting the switching levels from the share data. Figure 1 displays the theoretical switching and repeat purchase levels for brands, A, B and C. If the observed switching levels--SI (·) and SO (·)--are close to the theoretical ones, then brands A, B and C are in direct competition as assumed.

INSERT TABLE 1 AND FIGURE 1 HERE

MARKET PARTITIONING STRUCTURES

The use of Hendry partitioning approach leads to the identification of two forms of partitioning structures: (i) nested, and (ii) mixed-mode (Rubinson and Bass 1978). In mixed-mode partitioning structures, two product characteristics--say, brand label and type (or

form)--simultaneously form the primary partitioning level. The theoretical switching constants for switching between brand labels and types are obtained by finding their respective shares within the total market.

In the nested structures, type-primary or brand-primary, partitioning is sequential. For instance, in a type-primary structure, the theoretical switching constant for switching between types is obtained by finding the type shares within the total market. Then, the theoretical switching constants for switching between brands are calculated separately for each product type. In other words, at the secondary partitioning level, product types act as separate markets.

CONCLUDING COMMENTS

Knowledge of the true partitioning structure, or the market environment, is of great importance to marketers when designing marketing strategies. Type-primary structures call for different promotional and new-product introduction strategies than do brand-primary structures (Kalwani and Morrison, 1977). The Hendry Corporation deserves credit for introducing the notion of partitioning and for delineating its significance in the formulation of effective marketing strategies. A number of partitioning methods--hierarchical clustering of the inter-item switching matrix (or the inter-item similarity matrix), cross-price elasticities, and the Hendry approach--exist. All are susceptible to a common problem: establishing the validity of a partitioning structure that results from the use of any of these approaches. The Hendry model is to be praised for the development of explicit theoretical criteria for verifying the market partitioning results.

However, according to Kalwani (1979) there are some theoretical problems associated with the use of the Hendry partitioning approach. He questions the derivation of the theoretical switching constant which plays a central role in the Hendry partitioning approach and concludes that improved assumptions are needed in its derivation. Future research addressing these and other related issues is likely to yield important theoretical and practical insights for market partitioning.

Table 1

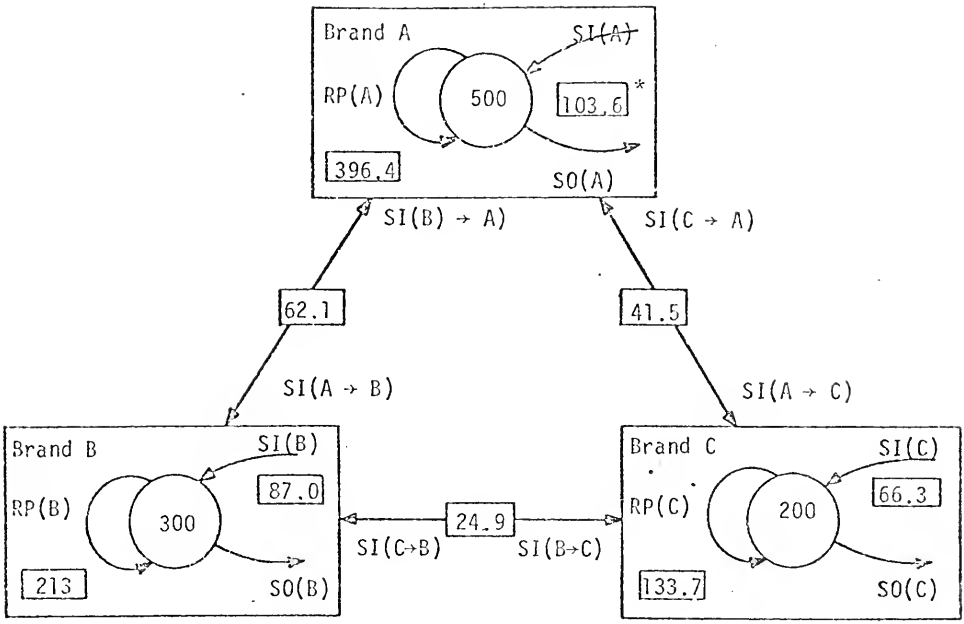
COMPUTATION OF THE THEORETICAL SWITCHING CONSTANT

Brand	Number of Buyers	Brand Share, S_i	$\frac{S_i 2_{ln}(1/S_i)}{1 + S_i \ln(1/S_i)}$	$S_i(1 - S_i)$
A	500	.5	0.1287	0.25
B	300	.3	0.0796	0.21
C	200	.2	0.0487	0.16
	1,000	1.0	0.2570	0.62

$$K_W = \frac{0.2570}{0.6200} = 0.4145$$

Figure 1

COMPUTATION OF THE THEORETICAL SWITCHING LEVELS



LEGEND: SI(·) = Observed number of consumers switching to a brand.
SO(·) = Observed number of consumers switching out of a brand.
RP(·) = Observed number of consumers who repeat buy a brand.

Theoretical switching levels are displayed in small rectangular boxes.

NOTES: 1. $103.6 = N K_W S_A(1 - S_A)$
$= 1000\ (0.4145)(.5)(.5)$

2. $SI(A) = SI(B \rightarrow A) + SI(C \rightarrow A)$

*A total of 500 buyers chose brand A on the last choice occasion. Of them, 103.6 were expected to be switching into brand A and 396.4 (= 500 - 103.6) were expected to be repeat buying it.

REFERENCES

1. Butler, David H., "Development of Statistic Marketing Models." Paper presented at the Educational Conference jointly sponsored by TIMS, ORSA and AMA, Rochester, New York, 1975.

2. Kalwani, Manohar U. and Donald G. Morrison, "A Parsimonius Description of the Hendry System." Management Science, Vol. 23, No. 5, January 1977, pp. 467-477.

3. Kalwani, Manohar U., "The Entropy Concept and the Hendry Partitioning Approach," MIT Working Paper, 1979.

4. Rubinson, Joel R. and Frank M. Bass, "A Note on 'A Parsimonious Description of the Hendry System'", Paper No. 658, Krannert Graduate School of Management, March 1978.

Date Due